

# Quality Flags in CMR Metadata

The ECHO metadata dialect includes two kinds of quality flags: [QAStats](#) and [QAFlags](#). We examined sample granule metadata records for ~4100 collections to determine how these flags were currently used. This table shows the number of flags / record in metadata collections from sixteen DAACS. Cells that are shaded red indicate that no occurrences exist. These data indicate that four of the DAACs include a significant number of standard quality flags in their granule metadata.

Path Elements	ASF	CDDIS	GES_DISC	GHRC	GSFCS4PA	LAADS	LANCEAMSR2	LANCEMODIS	LARC	LARC_ASDC	LPDAAC_ECS	NSIDC_ECS	OB_DAAC	ORNL_DAAC	PODAAC	USGS_EI
QAFlags/AutomaticQualityFlag					3.45				0.10	0.32	2.31	0.81				
QAFlags/AutomaticQualityFlagExplanation					3.45				0.86	0.32	2.31	0.81				
QAStats/QAPercentMissingData					0.30				0.21		2.25	0.73				0.36
QAFlags/OperationalQualityFlag					0.30				0.10		0.82	0.62				
QAFlags/OperationalQualityFlagExplanation					0.30				0.10		0.82	0.62				
QAFlags/ScienceQualityFlag					0.30				0.61		2.28	0.73				
QAFlags/ScienceQualityFlagExplanation					0.14				0.06		2.28	0.73				
QAStats/QAPercentOutOfBoundsData					0.25				0.06		2.17	0.36				
QAStats/QAPercentInterpolatedData					0.10				0.01		2.17					
QAStats/QAPercentCloudCover									0.06		2.02	0.25				0.82

The most commonly occurring quality flag is the AutomaticQualityFlag and the most common values for this flag are shown below along with the % of the values they make up. There are a total of sixty-four different AutomaticQualityFlag values and the nine values that occur more than 1% of the time are included in this table.

## Common values for AutomaticQualityFlag

Value	%
Passed	46.83%
parameter is produced correctly	27.32%
Based on percentage of product that is good. Suspect used where true quality is not known.	5.15%
No automatic quality assessment is performed in the PGE	5.07%
DummyValue	2.22%
Automatic quality determination software not yet implemented	1.61%
Process Terminated Normally - Check Science Quality Flag for Science Team quality assessment	1.43%
Passed indicates parameter passed for specific automatic test; Suspect, QA not run; Failed, parameter failed specific automatic test.	1.10%
Validated	1.01%

There are several immediate observations from these flag values. First, we would expect flags to be simple and somewhat consistent indicators of quality that might be used to drive a granule search. Many of these flags are more like phrases than flags and they are inconsistent. For example, the two most common flags are “Passed” and “parameter is produced correctly”. As a general indicator of quality these two values seem equivalent, but they could not be easily searched for. Similarly, the value “Validated”, while relatively infrequent, means essentially the same as the other two values. The same situation exists at the other end of the spectrum. The values “No automatic quality assessment is performed in the PGE” and “Automatic quality determination software not yet implemented” provide essentially the same information.

A second aspect of these values is that some appear to be explanations rather than flag values. For example, “Based on percentage of product that is good. Suspect used where true quality is not known.” or “Passed indicates parameter passed for specific automatic test; Suspect, QA not run; Failed, parameter failed specific automatic test.”

Similar observations can be made with the values in the AutomaticQualityFlagExplanation values (shown below) where “parameter is produced correctly” is the overwhelming most common value. The role of this field is to explain how that is determined, not to reiterate the AutomaticScienceQualityFlag.

## Common values for ScienceQualityFlag

parameter is produced correctly	52.55%
Based on percentage of product that is good. Suspect used where true quality is not known.	9.90%
No automatic quality assessment is performed in the PGE	9.76%
DummyValue	4.27%

Automatic quality determination software not yet implemented	3.09%
Process Terminated Normally - Check Science Quality Flag for Science Team quality assessment	2.74%
Passed indicates parameter passed for specific automatic test; Suspect, QA not run; Failed, parameter failed specific automatic test.	2.12%
Validated	1.95%
QA flag explanation	1.36%
All data passed during checkout	1.33%
No automatic quality assessment is performed in the PGE.	1.00%

Other standard flags yield similar observations, shown here for completeness.

#### Common values for OperationalQualityFlag

Passed	42.38%
Not Investigated	23.93%
Q/A process has not yet been run	8.79%
Passed,parameter passed the specified operational test. Inferred Pass,parameter terminated with warnings. Failed parameter terminated with fatal errors.	7.32%
Inferred Passed	5.86%
This granule passed operational tests that were administered by the OMI SIPS. QA metadata was extracted and the file was successfully read using standard HDF-EOS utilities.	2.64%
currently not used	1.95%
Data believed to be good, but there may be isolated exceptions	1.56%
Suspect	1.46%
no error detected	1.17%
Process Terminated Normally	1.17%

#### Common values for OperationalQualityFlagExplanation

Passed	34.38%
Not Investigated	12.89%
Q/A process has not yet been run	17.58%
Passed,parameter passed the specified operational test. Inferred Pass,parameter terminated with warnings. Failed parameter terminated with fatal errors.	14.65%
This granule passed operational tests that were administered by the OMI SIPS. QA metadata was extracted and the file was successfully read using standard HDF-EOS utilities.	5.27%
currently not used	3.91%
Data believed to be good, but there may be isolated exceptions	3.13%
no error detected	2.34%
Process Terminated Normally	2.34%
Process Terminated Normally - Check Science Quality Statement	1.17%

#### Common values for ScienceQualityFlag

Not Investigated	34.70%
Inferred Passed	19.86%
Passed,parameter passed the specified science test. Inferred Pass,parameter terminated with warnings for specified science test. Failed parameter terminated with fatal errors for specified science test.	4.53%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua</a> for the product Science Quality status.	4.53%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra</a> for the product Science Quality status.	3.86%
Validated, see <a href="http://disc.gsfc.nasa.gov/Aura/MLS/">http://disc.gsfc.nasa.gov/Aura/MLS/</a> for quality document	3.50%
Passed	2.96%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua&amp;ver=C6">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua&amp;ver=C6</a> for the product Science Quality status.	1.57%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra&amp;ver=C6">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra&amp;ver=C6</a> for the product Science Quality status.	1.57%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua</a> the product Science Quality status.	1.45%
An updated science quality flag and explanation is put in the product .met file when a granule has been evaluated. The flag value in this file, Not Investigated, is an automatic default that is put into every granule during production.	1.33%

#### Common values for ScienceQualityFlagExplanation

Passed,parameter passed the specified science test. Inferred Pass,parameter terminated with warnings for specified science test. Failed parameter terminated with fatal errors for specified science test.	11.05%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua</a> for the product Science Quality status.	11.05%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra</a> for the product Science Quality status.	9.43%
Validated, see <a href="http://disc.gsfc.nasa.gov/Aura/MLS/">http://disc.gsfc.nasa.gov/Aura/MLS/</a> for quality document	8.54%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua&amp;ver=C6">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua&amp;ver=C6</a> for the product Science Quality status.	3.83%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra&amp;ver=C6">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra&amp;ver=C6</a> for the product Science Quality status.	3.83%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=aqua</a> the product Science Quality status.	3.53%
An updated science quality flag and explanation is put in the product .met file when a granule has been evaluated. The flag value in this file, Not Investigated, is an automatic default that is put into every granule during production.	3.24%
See <a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/qaFlagPage.cgi?sat=terra</a> the product Science Quality status.	2.65%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13C1&amp;ver=C5.2016-02-20%2011">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13C1&amp;ver=C5.2016-02-20 02:11</a>	1.91%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13C2&amp;ver=C5.2016-02-05%2012">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13C2&amp;ver=C5.2016-02-05 02:12</a>	1.91%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13C1&amp;ver=C5.2016-02-28%2010">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13C1&amp;ver=C5.2016-02-28 02:10</a>	1.91%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13C2&amp;ver=C5.2016-02-17%2013">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13C2&amp;ver=C5.2016-02-17 02:13</a>	1.91%
no error detected	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13A1&amp;ver=C5.2016-02-20%2011">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13A1&amp;ver=C5.2016-02-20 02:11</a>	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13A2&amp;ver=C5.2016-02-20%2011">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13A2&amp;ver=C5.2016-02-20 02:11</a>	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13Q1&amp;ver=C5.2016-02-20%2011">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13Q1&amp;ver=C5.2016-02-20 02:11</a>	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13A1&amp;ver=C5.2016-02-27%2010">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13A1&amp;ver=C5.2016-02-27 02:10</a>	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13A2&amp;ver=C5.2016-02-27%2010">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13A2&amp;ver=C5.2016-02-27 02:10</a>	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13Q1&amp;ver=C5.2016-02-27%2010">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13Q1&amp;ver=C5.2016-02-27 02:10</a>	1.77%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13A3&amp;ver=C5.2016-02-05%2012">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MOD13A3&amp;ver=C5.2016-02-05 02:12</a>	1.62%
<a href="http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13A3&amp;ver=C5.2016-02-12%2010">http://landweb.nascom.nasa.gov/cgi-bin/QA_WWW/detailInfo.cgi?prod_id=MYD13A3&amp;ver=C5.2016-02-12 02:10</a>	1.62%

currently not used	1.33%
Data has not been validated. Consult the product quality statement.	1.33%
Initial evaluations show good agreement with field data and appropriate quality flags. Users are advised to examine band specific quality bits before using data in science applications..2016-02-20 02:12	1.03%

Note that the ScienceQualityFlags introduce URLs into the quality flag and explanation fields. This is an appropriate approach to providing more detailed explanations, but it is a strong commitment to persistence of these URLs.